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The Seven Challenges of Sustainable Cities

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Abstract
The departing point for this paper is that we do not know what a sustainable city is. The present situation is characterised be small demonstration projects and strategies for urban sustainable development that are not coherent. The modern city can be viewed as a complex technological system. The urban infrastructure, the buildings and their users interact in numerous and increasingly complex ways. The paper analyses some of the challenges cities meet in their quest for sustainability: lack of awareness and ethics; lack of tools for decision making; lack of models for sustainable urban management; lack of diffusion of innovations; the momentum of existing infrastructure; counteracting trends in the development of modern society and the need for reinventing planning.

Keywords
Infrastructure; Sustainable development; Context-dependency; Process-orientated; Urban Management; Planning.

1. Introduction

We talk of sustainable cities as if we know what this is. In this paper we underline that we should use the notion of sustainable development of cities rather than sustainable cities as we - at least not yet - have a sufficient idea of what a sustainable city is. The main purpose of the paper is to point out some of the major challenges of sustainable cities that one tend to forget when looking on demonstration projects and 'best practices'. Unfortunately there is not room for any in-depth analysis in such a short paper.

The EU Green Paper (CEC 1990) argued for a strengthening of the European cities as compact cities, while the urban ecologists promoted a vision of closing of the open material and energy cycles by small scale technology and self-supply, as in the famous "A Blueprint for Survival" (The Ecologist 1972). These can be seen as two extremities to illustrate the differences of perceptions. In Kristensen et al. (2001) the authors point to that these perceptions takes for granted, that cities are alike. Sustainable development of cities must be seen as an overall goal that can take many forms and be pursued by different strategies. To understand sustainable cities, it is necessary to understand how competing urban futures are socially constructed (Guy and Marvin 1999). It also implies that sustainable development of a city must be evaluated in relation to the specific context of that city, thus what is

a step towards sustainable development in one city might not be the right step in another city. The flexibility of sustainable development of cities on the other hand opens up for debate of the directions and for new ways of thinking. Sustainability is a challenge to the ways we think of cities and for the ways we try to govern and shape the development of the cities (Kristiansen et al., 2001).

1.1 The Present Situation

Despite much talk about urban sustainability, we are not able to point out a single city as an example of sustainable cities. What we find - and what is presented on this conference - are only small green islands in a vast grey ocean.

There are many demonstration projects, but most of them are in a limited scale, concerning only a few houses. Until late in the Nineties most of these experiments - at least in Denmark - have been characterised by: small scale; bottom-up initiative; transparent, simple technology with great symbolic value; single sector - not integrated - efforts (for example use of grey water); lack of documentation and evaluation of results and lack of systematic recording of experiences and collection of knowledge (Jensen et al 1998).

We find a number of small eco-settlements like Understenshoejdan in Sweden, Munkesoegaard in Denmark and Ecolonia in the Netherlands. A few attempts to larger developments like Nieuwland in the Netherlands, the Halifax project in Australia and Freiburg in Germany can be found. But there is far from these small examples to a sustainable development of the existing built environment.

The modern city can be viewed as a complex technological system. The urban infrastructure, the buildings and their users interacts in numerous and increasingly complex ways. Talking about infrastructure, many urban planners focus is on transport, the mantra 'the compact city is the sustainable city - the sustainable city is the compact city' is repeated over and over again. But there are more to the sustainable city than just planning a compact city.

1.2 Isolated Strategies

Different groups apparently work with different strategies for a sustainable development of the urban environment. At least four different strategies can be identified:

- One with focus on the individual building and the technical performance of the building - sustainable building, building ecology etc. An example of this strategy is saving electricity by designing a building with more daylight entering the building, using energy saving bulbs and equipment.
- One with focus on the behaviour of the residents or the users of the buildings, recognising the impact of user behaviour. An example of this strategy is saving

electricity by learning the residents and users to turn of the light when they leave the room.
- One with focus on the urban infrastructure replacing the existing infrastructure with a more 'sustainable' infrastructure. An example of this strategy is saving electricity, produced on fossil fuels, by introducing wind power as a part of the energy infrastructure.
- One with focus on the change of institutions and regulations. An example of this strategy is saving electricity by introducing green taxes.

However, none of these strategies can stand for alone. For example: In order to plan an adequate transition of infrastructure, you must have an idea of the future technical performance of the buildings and the impacts of the future user behaviour. You have to have an institutional set-up that prevents utilities from selling as much of their products as possible. You have to have a better understanding of the interaction between the building and the user behaviour. But unifying the strategies - or making them work in a coherent way is not enough. A number of challenges are to be met.

2. Seven Challenges for Sustainable Cities

In the following pages we will give a short description of some of the major challenges for sustainable cities, as we see them. For every challenge we try to suggest how the challenges might be (partly) met. The challenges we describe are of different nature and many of them are interrelated.

2.1 Lack of Awareness and Ethics

Most people consider themselves as environmentally aware. The question is, however, how this awareness influences daily life and the different decisions that are made every day. Apparently it does not lead to many actions, making the city more sustainable. Even though decision makers - be it laymen or politicians - are environmentally aware, they prioritise economy, comfort etc and not sustainable development. House owners, as an example, do not prioritise environment, when renovating their houses (Almlund et al, 2002). One of the reasons might be that in modern life many of the negative impacts of human activity are invisible and intangible. Most people have seen neither carbon dioxide nor the greenhouse effect. Sustainability has a strong ethical dimension. Some of the actions you carry out are not for your own benefit, but for the benefit of future generations - perhaps even in other regions of the world.

Branding and promoting "green products" have had a relatively large success. However, the rise of green branding means that a green identity and awareness is becoming a thing you can buy. Buying green products is an important way to demonstrate to others (and yourself) that you are environmentally aware.

However, the most sustainable choice: simply not buying at all is quite difficult to brand. Unlike green products, the non-buying strategy has no salesmen, no stakeholders, no marketing strategy. It is a major challenge giving environmentally friendly actions, technologies and consumption-patterns a name, image and identity that is able to appeal to other groups than the "traditional" green segment, who is already in the game.

Awareness has to be increased to a level that environmental aspects are considered in everyday life. The invisible, intangible parts of the negative human impact on the environment have to become visible and tangible. 'Swimming in the harbour in central Copenhagen' is a good example. It can be difficult to put details of minor water pollution on the political agenda. A major break-through came when the mayor declared that it should be possible to swim in the harbour in central Copenhagen. The environmental goal became quite tangible. More investments in sewage treatment were made, and swimming in the harbour is enjoyed by many citizens of Copenhagen.

2.2 Lack of Tools for Decision Making

Although many of the projects that are considered as being best practices in urban sustainability have been decided without the use of (advanced) tools to support the decision, tools for a wider greening of the sectors are needed:

- To map, evaluate and visualise the present state of the sector, the goals for sustainability in the sector, and the difference between the goals and present state ("Sustainability Gaps").
- To assess the sustainability of different possible strategies and solutions (environmental, social, economic), and to prioritise between them (for instance multi-criteria analysis).
- For guiding actors through the processes of implementing sustainability in projects and strategies.

The need for tools to assess urban sustainability projects is evident. If there is no systematic evaluation, no lessons will be learned - the same mistakes will repeat, and the good projects will not be used in other places. Without using environmental evaluation or assessment, the main effort for sustainable development might become a symbolic expression of a few "green" solutions - e.g. examples on green architecture, or other visual expressions on sustainability.

Using assessment methodologies for decision support consequently will probably raise question if solutions, traditionally considered as "green", actually is recommendable, or if there are other ways to make the city more sustainable. Our interim research in the PETUS-project seems to indicate several examples on this.

Although a number of tools on all three levels have actually been developed, and are described in the literature, in articles, on the Web etc., the actual use of the tools in practice is probably limited. There are several reasons for this:

- There is a long distance from research to practice, and little knowledge of the tools being developed.
- It takes time and resources to learn, use and implement the tools - "business as usual" or "ad hoc" methods are often the easiest way to cope with the problems in a short term.
- Using tools implies different decision procedures. Tools are not independent modules to be added, for instance, at the final stage of the decision process - they are often an integrated part of the whole process, from designing and prioritising too implementing. Using the tools optimally often demands organisational changes.
- The tools might be either too abstract or too case-specific, which will make it difficult to use in any other cases in practice. It is often difficult to encompass all the different relevant parameters in the decision procedure. The fact that a number of parameters are locally dependent makes the work of creating a proper basis for the decisions even harder.
- The tools need legitimacy, i.e. have to be recognised by authorities, organisations, other users etc. The existence of many different tools and methods, which might not always point in the right direction emphasises the need for legitimacy and transparency.
- The amount of relevant data available or accessible is often limited. For instance, data on energy, water, waste on neighbourhood/block level is often rather complicated to collect, if they exist at all.

The first challenge is to get an overview over the numerous decision support tools that already exist and focus on the tools that reflect the values of the different actors in the best way. We have - like many others - tried to develop methods for involving stakeholders in decisions concerning sustainable infrastructure (Hoffmann et al, 2000).

To involve stakeholders and citizens is one of the basic elements in the formulation of the Danish version of Local Agenda 21-strategy. As a part of formulating goals for the LA21 in Copenhagen an interview survey (on what environmental problems were regarded as the most pressuring) amongst app. 1.500 citizens was conducted. Also, several workshops with citizens, public officers, infrastructure managers etc. have been held on different urban sustainability issues, to decide on which input for direction to feed the LA21-plan.

2.3 Lack of Models for Sustainable Urban Management

Some models for environmental management of companies exist. Advanced municipalities try to implement these models in the municipal organization. The administration in the Municipality of Albertslund (a Copenhagen suburb) has been EMAS-certified. However, a sustainable city administration does not make the entire city sustainable. Hence, the giant leap is the sustainable management of the geographic entity of the municipality, with its numerous stakeholders and their

different positions. The city is not a company, the organizational structure is much softer - the business way of environmental management cannot bee directly implemented.

The different elements in the city will have their own path towards sustainability. Sustainable urban management will have to recognize the many single actors and their characteristics. The uncertainties and the complexity of the informal organization of the city must be respected. The different actors will have their own agenda for sustainable development - factories, housings companies, utilities etc. Soft management methods have to be introduced. Partnerships could play an essential role. Different kinds of intermediaries could be introduced as part of navigating towards a sustainable development.

2.4 Lack of Diffusion of Innovations

A surprisingly large number of demonstration projects remain just that - the innovations tested are not used in other projects. One of the reasons for the lack of diffusion is the missing focus on documentation and dissemination of the results. In practice attention is concentrated on the innovation itself and the realization of the demonstration project (van Hall 2000). A pressure for more demonstrations projects exits.

It is evident that better documentation of the demonstration projects is an essential part of the information transfer. Anke van Hall (2000) concludes that: *The chance of diffusion of environmental innovations in housing (and thus commercial success) increases particularly when the information transfer related to the innovation is well organised.* Special attention has to be paid to context dependency. It is essential to be able to recognise whether a certain innovation can be transferred to another local context or not.

2.5 The Momentum of Existing Infrastructure

A number of 'green' technologies in 'green' buildings are in conflict with the existing infrastructure. The classical Danish example is the conflict between solar panels and district heating based on combined heat and power production: Solar heating is most efficient in the period when the 'surplus heat' from the combined heat and power production is plenty. That was the reason why some of the early eco-settlements were situated in rural areas without district heating (Jensen, 2002).

The modern city and its infrastructure can be viewed as a large technological system. Large technological systems have a substantial momentum - they are difficult to change (Hughes 1987). The systems are complex and interdependent - For example: Solid waste is used as 'fuel' for combined heat and power production

in Copenhagen. Hence it can be quite difficult to introduce new technologies. The innovation itself is far from enough.

However, the anticipated momentum is not always a problem. Reverse salients, appropriate areas for implementing new technologies, can be identified. A case study of the Berlin water sector shows that several 'new' technologies can co-exist with the existing water infrastructure, a study in the Copenhagen regions shows similar results (Guy et al, 2001). The transition of urban infrastructure has to be planned and coordinated with the development in the building sector. Decision makers have to accept that parallel solutions occur in the transitions period.

2.6 Counteracting Trends in the Development of Modern Society

Some of the essential trends in the development of modern society counteract sustainable development - some of the important trends are globalisation, smaller family units and growing use of floor space.

Globalisation and the knowledge based society results in more transport, because goods and people have to be transported for longer and longer distances. Products, demanding a lot of manual work, are often produced outside Europe, where the wages are smaller. Two well-educated people, living together, will often have difficulties in finding jobs in the same area - and hence difficulties to both live close to their job.

Families are getting smaller and smaller - more and more people are living single or as single parents. This has, combined with economic growth, lead to the fact that more and more floor space per person is being used. The present Danish average use of floor space per person for living is almost 60 m^2. As much of the building's resource use is related to the floor space, this trend counteracts sustainable urban development. This is a trend in still more EU-countries, according to the European Environmental Agency (EEA), who notes: "... Europeans may use more energy efficient appliances in their homes, for example, as a whole, their homes consume more energy than they did before" (EEA, 2001).

However, from recent surveys we also know that even between families living on the same amount of space there can be quite substantial difference in the resources consumed (electricity, heating and water). This is often due to as well different dwelling cultures and lifestyles, but also to different technological efficiency and ordinary everyday habits, that can be changed through learning, information, good examples, experience etc. We also know from several projects that it is actually possible to change the behaviour of the residents towards less consuming practices - without changing their entire lifestyle.

2.7 The Need for Reinventing Planning

Planning has apparently been reduced to basic spatial planning in some municipalities, at least in Denmark (Sehested, 2002). From being the heroes that saved cities from destruction in rapid growth in the 60ies and the early 70ies, planners are now perceived as rigid bureaucrats that are not able to deliver the wished growth - a perception that limits the power of the planners. Examples of planning that limits the creativity of the individual, flourish in the media. This makes it difficult for planners to play an active role in 'planning for sustainability' in the cities.

Planners have to see themselves as a part of a larger professional ensemble, facilitating sustainable urban management, catalysing the dialogue among citizens and other stakeholders. A central question for planners concerns the professionalism and quality of the dialogue and the development. How to qualify the actors - without giving them the planner's own solutions? The other pitfall for the planner is to be an uncritical 'holder of the microphone' for the different actors, and thus hide behind the most powerful. In our research we talk of the function of a 'critical friend': on the one side the planner is loyal to the actors and process, on the other side the planner points out effects and ask the critical questions in order to secure the substance and the professionalism.

3. The Learning City

There is no simple way of describing a sustainable city. The city and its infrastructure is a large, complex technological system, and the paths towards sustainability are many and context dependent. What is the right step towards sustainability in one city might not be the right step in another city.

It is necessary that all the different actors in the cities engage in a common, continuous learning process. We have to learn to make the issue of sustainability visible and tangible. We have to learn to put sustainability on the agenda in a way that leads to major changes in the ways cities are managed and in the ways their citizens act in their daily life, not only to a few demonstration projects. We have to learn how to find the right ways of assessing and evaluating projects - and the way to disseminate the results and diffuse the innovations. We have to learn how to involve the different intermediaries in reaching each single actor in the city.

We have to learn from the experiences of other cities, not to copy the solutions, but to be inspired by them and perhaps to adapt them to our own specific local context. We have to learn from how others are engaged in a common, continuous learning process.

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